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IMPACT OF EGG VIABILITY, EGG PARASITISM, AND VIRUS ON 1974 DOUGLAS-FIR TUSSOCK MOTH DEFOLIATION POTENTIAL IN NORTHERN IDAHO

by

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INTRODUCTION

Egg mass surveys designed to assess potential defoliation by Douglas-fir tussock moth, *Orgyia pseudotsugata* McD., in northern Idaho were conducted during the fall 1973 through the cooperative effort of a special task force of the Northern Rockies Forest Pest Action Council (Tunnock and Livingston 1974). As part of this survey, supplemental collections of egg masses were made in order to assess effects of egg viability, egg parasitism, and virus on defoliation potential and readjust proposed treatment boundaries accordingly.

METHODS

During the fall egg mass survey (Tunnock and Livingston 1974), five new egg masses were collected from plots sampled which contained new egg masses. These were stored in a cooler at 35° F. until February 1974. In February, half of each egg mass was placed in a Petri dish and incubated at 78° F. and 30 percent relative humidity. Eggs usually hatched after 14 days. All larvae and egg parasites were counted in each dish. From 20 to 30 larvae were retained in the Petri dish, and the egg mass was placed in another Petri dish to complete hatching. Larvae were fed on artificial media and kept in the incubator for 14 days. At the end of 14 days each dish was examined for dead larvae. Dead larvae were smeared

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on a slide and examined under a compound microscope for presence of virus polyhedra. Percentage of larvae killed by virus was computed for each plot.

Egg masses that were transferred to a second Petri dish were dissected and all unhatched eggs counted per mass. Any additional emerged larvae and parasites in each dish were counted. From these data, average number of eggs per mass, percent nonviable eggs, and percent egg parasitism were determined for each plot.

A partial life table (Table 1) was prepared from the above data to determine estimated larvae (viable eggs) per 1,000 square inches of foliage on each plot. The virus level and estimated larval density per 1,000 square inches of foliage were used in a key (Tunnock and Livingston 1974) which established if an area qualified for treatment (high risk).

RESULTS

Percent nonviable eggs ranged from 0.3 to 68.9, and egg parasitism ranged from 0 to 14.9 percent (Table 1). Two species of egg parasites were recovered, *Telenomus californicus* Ashm.[3/] (Hymenoptera: Scelionidae) and *Trichogramma minutum* Riley[4/] (Hymenoptera: Trichogrammatidae). *T. californicus* was the more abundant of the two.

Virus incidence was generally low throughout the infestation, averaging 1.1 percent on the Coeur d'Alene Unit, 3.3 percent on the St. Joe Unit, 0.3 percent on the Craigmont Unit, 5.8 percent on the Salmon River portion of the Nezperce Unit, and 2.5 percent on the Selway River portion of the Nezperce Unit. Virus incidence on the Coeur d'Alene and Selway River areas is sufficiently low to retain their status as test sites for pilot control projects of two microbial agents--the natural virus and *Bacillus thuringiensis*.

Acreage adjustments by unit are as follows:

Coeur d'Alene Unit.--The number of acres qualifying for treatment in this unit was decreased by 15,271 acres from 34,138 to 18,867 acres (Fig. 1).

St. Joe Unit.--Acres to be treated in this unit were decreased from 64,779 to 46,103 (Fig. 2).

Clearwater Unit.--There was no reduction in the number of acres to be treated in this unit. It remained at 4,433 acres.

Craigmont Unit.--There was no reduction in the number of acres to be treated in this unit, remaining at 4,762 acres.

3/ Determined by Paul Marsh, USDA, Agricultural Research Service, Insect Identification and Parasite Introduction Research Branch, Beltsville, Maryland.

4/ Determined by B. D. Burks, USDA, Agricultural Research Service, Insect Identification and Parasite Introduction Research Branch, Beltsville, Maryland.

Nezperce Unit.--There was a reduction in number of acres qualifying for treatment only on the Selway River subunit. This was a decrease from 33,501 to 29,713 acres. New proposed treatment boundaries of the Selway subunit are shown in Figure 3.

Areas of 1973 defoliation within the 1974 proposed treatment area by ownership and damage class are summarized in Table 3.

DISCUSSION

The 1973 fall egg mass survey was based on the best information available on the biology, ecology, and population dynamics of the Douglas-fir tussock moth. We recognize that it is very possible our sampling procedures were not capable of detecting high concentrations of egg masses in upper crowns.

Supplemental ground surveys are planned for early spring to verify existing survey data in areas designated as "spray option." Trees will be felled to detect presence of new egg masses concentrated in upper crowns which might cause severe defoliation. If there are high concentrations of new egg masses in upper crowns, these areas will be included in proposed treatment units.

REFERENCE CITED

Tunnock, S., and R. L. Livingston, 1974. Potential Douglas-fir tussock moth damage in northern Idaho in 1974 based on a 1973 fall egg mass survey. USDA Forest Serv., N. Region, Div. State & Priv. Forestry, insect & disease report 74-4.

Table 1.--Data from northern Idaho Douglas-fir tussock moth egg masses hatched in the laboratory during winter 1974.

(1) Plot location T.	R.	Sec	(2) New egg masses/ 1000 sq. inches foliage	(3) Mean number eggs/ mass	(4) (2x3) Eggs/ 1000 sq inches	(5) Percent non-viable eggs	(6) Percent egg para-sitism	(7) Est.larval density/ 1000 sq. inches at egg hatch	(8) Percent virus	(9) Estimated larvae/ 1000 sq. in. after virus	(10) Risk* (high or low)
						ST. JOE UNIT					
40N	3W	29	--	175	--	68.9	2.5	--	1.3	--	--
41N	2W	22	0.07	244	17.1	29.1	12.2	10.7	2.4	10.5	Low
41N	3W	5	.04	220	8.8	4.5	9.1	7.6	0	7.6	Low
42N	3W	6	.18	226	40.7	13.1	.5	35.2	2.9	34.2	High
42N	3W	18	.66	209	137.9	33.2	6.3	86.3	4.2	82.7	High
42N	3W	32	.01	252	2.5	3.5	.3	2.4	0	2.4	Low
42N	3W	8	.02	280	5.6	7.9	0	5.2	0	5.2	Low
42N	3W	16	.02	134	2.7	10.4	10.4	2.2	0	2.2	Low
42N	3W	19	.28	203	56.9	13.8	4.5	46.9	9.6	42.4	High
42N	4W	3	.47	198	93.1	18.6	14.9	64.5	2.2	63.1	High
[illegible]N	4W	18	.03	180	5.4	8.4	0	5.0	5.3	4.7	Low
[illegible]N	4W	1	.07	164	11.5	16.8	.3	9.6	2.5	9.4	Low
42N	4W	28	--	222	--	7.2	0	--	2.0	--	--
42N	4W	2	.91	192	174.7	24.4	13.1	114.8	0	114.8	High
42N	4W	11	.21	200	42.0	6.0	1.3	39.0	0	39.0	High
42N	4W	13	.10	110	11.0	12.1	6.1	9.1	7.3	8.4	Low
43N	2W	20	.02	118	2.4	53.9	.6	1.1	0	1.1	Low
43N	2W	28	.18	178	32.0	37.5	0	20.0	2.8	19.4	Low
43N	2W	19	.64	200	128.0	25.2	0	95.8	3.0	92.9	High
43N	3W	4	.44	148	65.1	23.3	9.5	45.2	1.7	44.4	High
43N	3W	26	.22	168	37.0	21.5	0	29.1	1.4	28.7	High
43N	3W	22	.44	236	104.0	7.9	0	95.8	0	95.8	High
43N	3W	35	.04	210	8.4	46.7	1.4	4.4	3.7	4.2	Low
43N	4W	18	.09	172	15.5	38.2	4.2	9.2	14.5	7.9	Low
43N	4W	17	.34	232	78.9	56.2	4.2	33.2	5.3	31.4	High
43N	4W	26	.42	180	75.6	17.9	6.3	58.2	10.0	52.4	High
43N	4W	35	.68	172	117.0	11.6	2.3	101.0	0	101.0	High
43N	4W	5	.52	194	100.9	27.0	3.5	71.1	1.7	69.9	High
43N	4W	6	.02	185	3.7	21.3	.8	2.9	2.3	2.8	Low
43N	4W	8	.35	224	78.4	15.4	1.3	65.4	2.1	64.0	High
43N	4W	20	--	218	--	23.5	2.3	--	1.9	--	--
43N	4W	32	.06	234	14.0	3.4	0	13.5	0	13.5	Low
43N	5W	12	.03	200	6.0	17.0	0	5.0	5.0	4.8	Low

*Risk of defoliation is "high" on plot if estimated larval density exceeds 20 larval per 1000 sq. in. of foliage or if virus levels are less than 30 percent in class III or IV areas or less than 50 percent in class I or II areas.

Table 1.--Data from northern Idaho Douglas-fir tussock moth egg masses hatched in the laboratory during winter 1974, con.

(1) Plot location			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
T.	R.	Sec	New egg masses/ 1000 sq. inches foliage	Mean number eggs/ mass	(2x3) Eggs/ 1000 sq inches	Percent non-viable eggs	Percent egg parasitism	Est.larval density/ 1000 sq. inches at egg hatch	Percent virus	Estimated larvae/ 1000 sq. in. after virus	Risk* (high or low)
						ST. JOE UNIT					
43N	5W	22	0.28	201	56.3	26.6	0	41.3	1.5	40.7	High
43N	5W	24	.35	196	68.6	28.0	8.4	45.3	13.1	39.4	High
43N	5W	27	.11	222	24.4	19.7	11.7	17.3	0	17.3	Low
44N	2W	11	.04	220	8.8	18.7	0	7.2	1.1	7.1	Low
44N	3W	17	.76	208	158.1	3.8	7.7	140.4	13.7	121.2	High
44N	3W	8	.03	208	6.2	3.5	.3	6.0	1.7	5.9	Low
44N	3W	18	.07	150	10.5	33.1	1.9	6.9	6.0	6.5	Low
44N	4W	11	.07	208	14.6	10.0	.4	13.1	8.1	12.0	Low
45N	3W	36	.04	222	8.9	25.4	1.2	6.5	3.1	6.3	Low
[illegible]5N	3W	15	.09	200	18.0	7.0	0	16.7	1.3	16.5	Low
[illegible]N	3W	17	.02	240	4.8	13.0	0	4.2	0	4.2	Low
[illegible]N	4W	34	--	200	--	27.6	0	--	13.4	--	--
45N	4W	2	.09	220	19.8	10.0	0	17.8	0	17.8	Low
45N	4W	10	.01	236	2.4	8.1	5.6	2.1	1.6	2.1	Low
45N	4W	16	.06	250	15.0	10.8	1.0	13.3	6.3	12.5	Low
45N	4W	28	.67	250	167.5	6.9	0	156.0	2.2	152.6	High
45N	4W	33	.04	208	8.3	13.1	12.8	6.3	2.9	6.1	Low
45N	4W	21	.12	174	20.9	20.7	0	16.6	0	16.6	Low
						COEUR D'ALENE UNIT					
46N	4W	35	--	--	--	--	--	--	0	--	--
48N	3W	2	.12	256	30.7	10.2	0	27.6	0	27.6	High
49N	2W	29	.32	156	49.9	4.5	0	47.7	1.3	47.1	High
49N	2W	26	.14	210	29.4	10.0	0	26.5	0	26.5	High
49N	2W	23	.03	190	5.7	12.0	2.0	4.9	0	4.9	Low
49N	2W	20	.02	137	2.7	11.7	1.5	2.4	1.1	2.3	Low
49N	2W	31	.02	165	3.3	17.0	5.0	2.6	0	2.6	Low
49N	2W	12	.02	175	3.5	6.0	1.0	3.3	1.2	3.3	Low
49N	2W	16	.47	192	90.2	8.8	.2	82.1	1.1	81.2	High
49N	2W	14	.06	150	9.0	3.1	0	8.7	0	8.7	Low
49N	2W	9	.05	156	7.8	20.1	0	6.2	0	6.2	Low
49N	2W	32	.01	142	1.4	41.3	0	.8	0	.8	Low
49N	2W	7	.06	222	13.3	5.4	0	12.6	3.3	12.2	Low
49N	2W	8	.09	218	19.6	.5	0	19.5	0	19.5	Low
[illegible]N	2W	21	.15	138	20.7	2.6	0	20.2	0	20.2	High
[illegible]N	2W	22	.14	206	28.8	.3	0	28.7	0	28.7	High

Table 1.--Data from northern Idaho Douglas-fir tussock moth egg masses hatched in the laboratory during winter 1974, con.

(1) Plot location			(2)	(3)	(4)	(5)	(5)	(7)	(8)	(9)	(10)
T.	R.	Sec	New egg masses/ 1000 sq. inches foliage	Mean number eggs/ mass	(2x3) Eggs/ 1000 sq inches	Percent non-viable eggs	Percent egg parasitism	Est.larval density/ 1000 sq. inches at egg hatch	Percent virus	Estimated larvae/ 1000 sq. in. after virus	Risk* (high or low)
					COEUR D'ALENE UNIT						
49N	3W	33	0.04	184	7.4	3.3	0	7.2	3.3	7.0	Low
49N	3W	24	.65	198	128.7	2.7	0	125.2	2.4	122.2	High
49N	3W	25	.73	144	105.1	5.5	0	99.3	.9	98.4	High
49N	3W	14	.49	136	66.6	7.1	1.1	61.2	10.7	54.7	High
49N	3W	36	.03	180	5.4	7.7	0	5.0	0	5.0	Low
50N	2W	36	.01	178	1.8	6.0	0	1.7	0	1.7	Low
					NEZPERCE (SALMON) UNIT						
23N	1W	29	.51	154	78.5	38.5	2.9	29.3	30.0	20.5	High
[illegible]	1W	27	.48	166	79.7	44.6	5.3	42.0	6.1	39.4	High
[illegible]	1E	6	.33	176	58.1	9.0	3.4	51.2	0	51.2	High
26N	1E	16	--	98	--	47.0	2.0	--	0	--	--
26N	1E	31	.46	112	51.5	7.5	8.5	43.6	2.3	42.6	High
27N	1E	33	1.80	216	388.8	7.8	5.5	338.8	2.4	330.7	High
27N	2E	35	--	122	--	35.9	6.0	--	2.7	--	--
27N	2E	--	--	214	--	19.4	7.9	--	3.1	--	--
					NEZPERCE (SELWAY) UNIT						
31N	5E	35	.09	200	18.0	5.6	5.0	16.2	0	16.2	Low
31N	5E	24	.10	110	11.0	8.6	1.4	10.0	12.6	8.7	Low
31N	7E	6	.41	176	72.2	12.4	7.9	58.3	0	58.3	High
32N	6E	16	--	134	--	6.7	.7	--	.8	--	--
32N	6E	28	--	164	--	31.1	14.6	--	2.0	--	--
32N	6E	25	.10	156	15.6	14.6	0	13.3	0	13.3	Low
32N	6E	34	.22	166	36.5	9.2	0	33.2	5.0	31.5	High
32N	7E	30	--	316	--	3.8	13.9	--	0	--	--
					CRAIGMONT UNIT						
33N	3W	29	.31	205	63.5	10.0	1.2	56.5	.6	56.2	High
33N	3W	20	.08	198	15.8	8.2	6.3	13.6	0	13.6	Low

Table 2.--Acres of proposed treatment, and treatment option in northern Idaho during 1974.

Unit	Proposed treatment	Treatment option
Coeur d'Alene		
State and private	998	4,096
Forest Service	17,869	24,678
Subtotal	18,867	28,774
St. Joe		
Coeur d'Alene Indian Reservation	988	3,512
State and private	30,268	80,317
Forest Service	14,847	13,670
Subtotal	46,103	97,499
Clearwater		
State and private	2,686	861
Forest Service	1,747	547
Subtotal	4,433	1,408
Craigmont		
State and private	4,762	7,162
Forest Service	0	0
Subtotal	4,762	7,162
Nezperce		
State and private	1,312	1,045
Forest Service	28,401	17,668
Subtotal	29,713	18,713
Northern Idaho total	103,878	153,556

Table 3.--Areas of 1973 defoliation within the 1974 proposed treatment area (by ownership and damage classes).

Area	Acres of defoliation by damage class*					
		Overlap acres			New acres	
	Dead	Class I	Class II	Class III	Class IV	Total
Northern Idaho						
Nezperce unit						
Nezperce NF	0	468	0	10,423	17,510	28,401
State and private	0	312	0	0	1,000	1,312
Subtotal		780		10,423	18,510	29,713
Craigmont unit						
State and private	0	0	250	799	3,713	4,762
Clearwater unit						
Clearwater NF	0	0	0	0	1,747	1,747
State and private	0	0	120	0	2,566	2,686
Subtotal			120		4,313	4,433
St. Joe unit						
St. Joe NF	0	425	1,573	8,274	4,575	14,847
Coeur d'Alene IR	0	505	48	300	135	988
State and Private	0	2,437	870	16,766	10,195	30,268
Subtotal		3,367	2,491	25,340	14,905	46,103
Coeur d'Alene Unit						
Coeur d'Alene NF	0	200	700	490	16,479	17,869
State and private	0	0	30	50	918	998
Subtotal		200	730	540	17,397	18,867
Northern Idaho subtotal		4,347	3,591	37,102	58,838	103,878

*Class I - 50 percent or more of the host type has been completely defoliated.
Class II - 50 percent or more of the host type has at least the top quarter of the crown completely defoliated.
Class III - Host type has defoliation visible from survey aircraft. The current year's foliage has been removed on most trees, but less than a quarter of the crown has been completely defoliated.
Class IV - Defoliation is not readily visible.

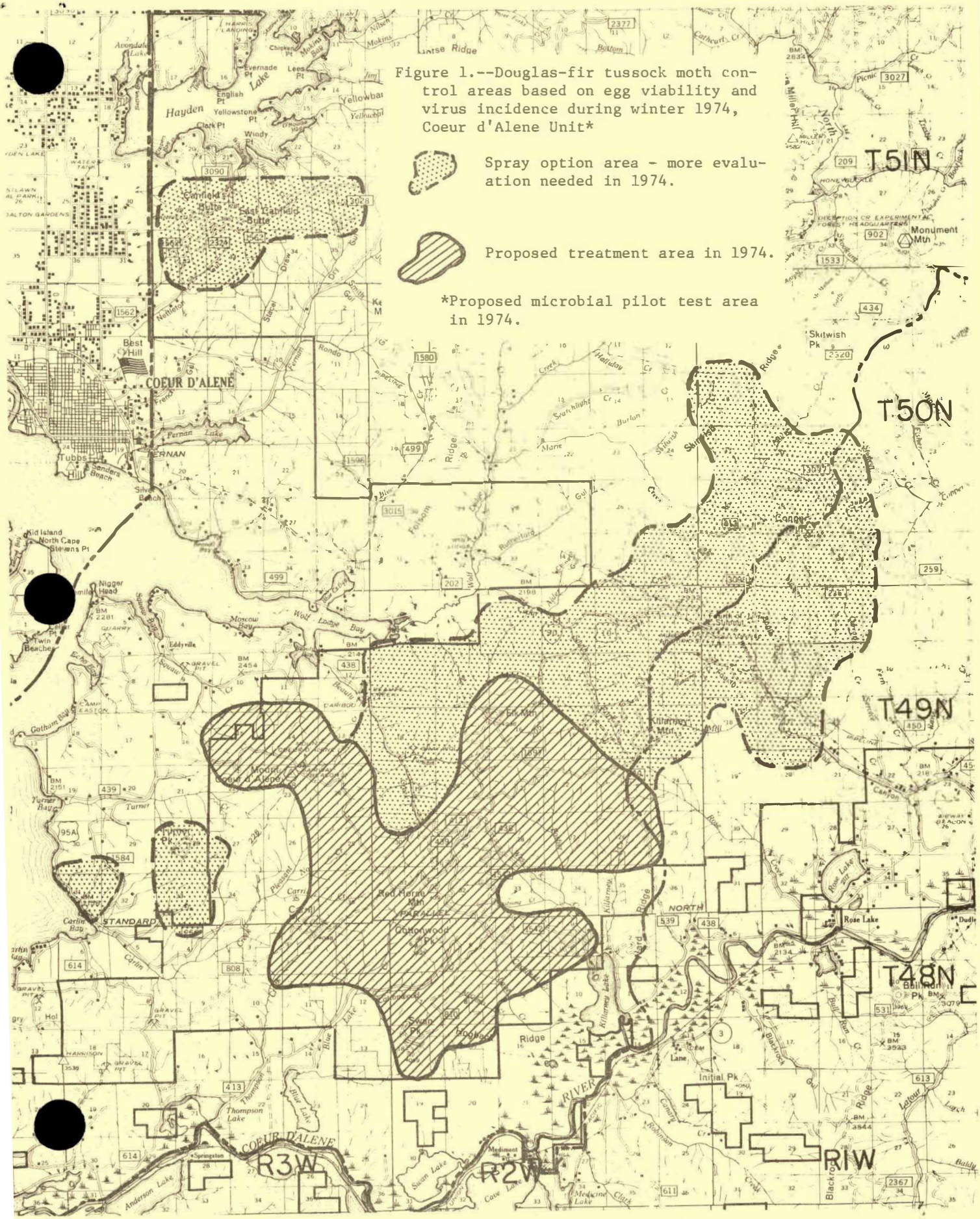
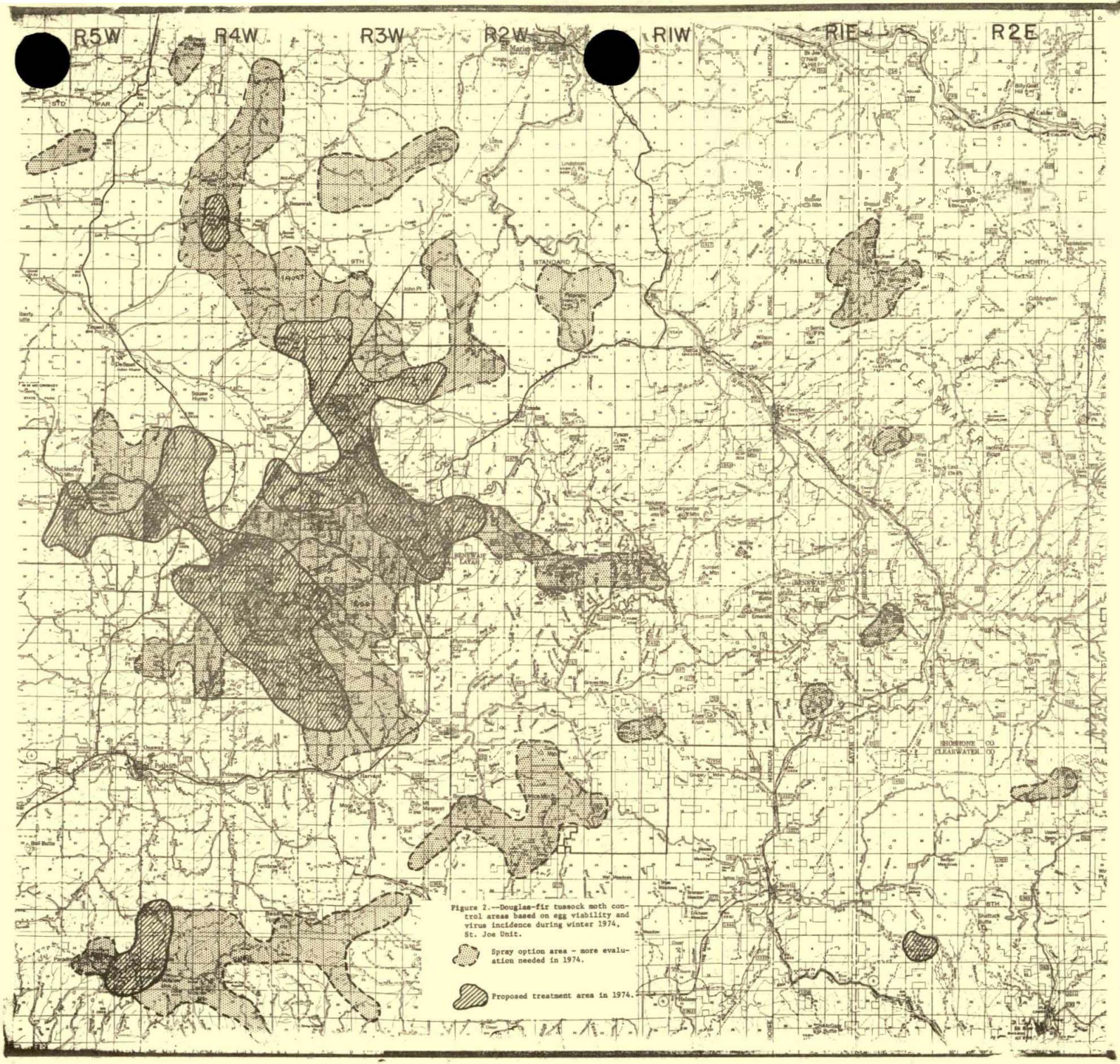


Figure 1.--Douglas-fir tussock moth control areas based on egg viability and virus incidence during winter 1974, Coeur d'Alene Unit*

Spray option area - more evaluation needed in 1974.

Proposed treatment area in 1974.

*Proposed microbial pilot test area in 1974.


R5W
R4W
R3W
R2W
R1W
R1E
R2E
Figure 2.--Douglas-fir tussock moth control areas based on egg viability and virus incidence during winter 1974, St. Joe Unit.
Spray option area - more evaluation needed in 1974.
Proposed treatment area in 1974.

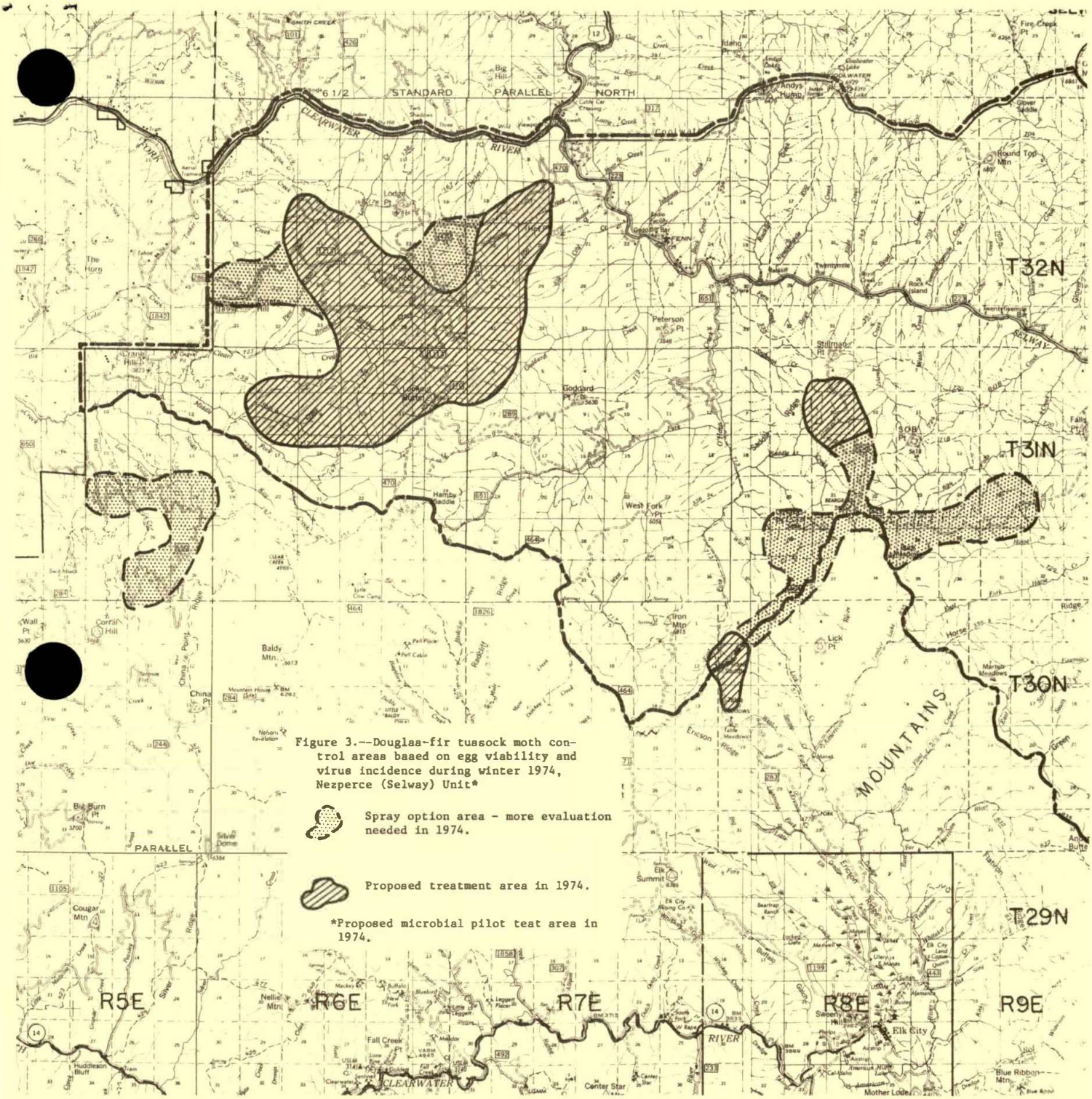


Figure 3.--Douglaa-fir tussock moth control areas baaed on egg viability and virus incidence during winter 1974, Nezperce (Selway) Unit*

Spray option area - more evaluation needed in 1974.

Proposed treatment area in 1974.

*Proposed microbial pilot teat area in 1974.